

### Combined Heat and Power

Combined heat and power (CHP) systems, also referred to as *cogeneration*, generate on-site electricity and useful thermal energy in a single integrated system. As a result, well-designed CHP systems consume less fuel than would be required to obtain electricity and thermal energy separately. Since less fuel is consumed, CHP systems offer greenhouse gas (GHG) reduction benefits over the conventional method of obtaining heat from a boiler and power from the electric grid. Additionally, since CHP system energy is consumed on-site as a form of distributed generation (DG), no energy is lost through transmission, adding to the energy savings.

CHP can also provide opportunities to use renewable fuels. For example, wastewater treatment facilities are ideal for developing CHP systems as they use the waste heat onsite to warm the digesters and export excess renewable electricity to the grid.<sup>1</sup> Other potential bioenergy sites that could use CHP include dairies, food processing plants, and forestry camps. However, the feasibility of developing CHP at such sites depends on a large and constant need for waste heat throughout the year.

DG, including CHP, has been recognized and encouraged by the California Energy Commission since the 1990s as a valuable alternative to developing new fossil-fueled, central-station power plants to meet California's growing energy demands. DG and CHP are also key elements of California's "loading order," following energy efficiency, demand response, and renewable energy.

Two state policies set the goals for CHP development in California. One is Assembly Bill 32 (AB 32, Núñez, Chapter 488, Statutes of 2006), the Global Warming Solutions Act. Under this act, the California Air Resources Board (ARB) prepared an *AB 32 Scoping Plan* that includes a reduction goal of 6.7 million metric tons (MMT) of carbon dioxide (CO<sub>2</sub>) from CHP resources. Also, Governor Brown's Clean Energy Jobs Plan calls for 6,500 megawatts (MW) of new CHP capacity by 2030.

California's goals align with those of the nation as President Obama issued an Executive Order calling for 40 gigawatts of new CHP by 2020.<sup>2</sup>

These policy goals have a significant effect on electric system planners and operators. Sites that use CHP electricity onsite reduce the need for grid electricity, thereby affecting the retail electric sales forecast and the amount of renewable generation needed to meet California's

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1 O'Neill, Garry, John Nuffer. 2011. 2011 Bioenergy Action Plan. California Energy Commission, Efficiency and Renewables Division. Publication number: CEC-300-2011-001-CMF.

2 <http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency>.

Renewables Portfolio Standard (RPS) requirements. For more information about the RPS, see <http://www.energy.ca.gov/portfolio/index.html>.

### CHP Market Potential

A 2011 report by ICF International, Inc., studied the long-term potential for CHP in California and the degree to which CHP can reduce potential GHG emissions over the next 20 years. The report examines three possible scenarios using existing state policies in a Base Case and two additional cases (Medium and High) to show the market effects of additional CHP policy actions and incentives including, but not limited to an extension of the Self-Generation Incentive Program, reduction of standby and demand charges, and changes to export pricing. The additional cases were designed to prompt discussion and provide perspective as to what degree of development may occur if certain policy actions are taken. A summary of the results are provided in **Table 1**.<sup>3</sup>

**Table 1: ICF Study of Combined Heat and Power Potential: 2030 Cumulative New Market Penetration by Scenario (MW)**

Scenarios	On-Site	Export	Avoided Air Conditioning	Total
Base Case	1,513	213	160	<b>1,886</b>
Medium Case	1,782	1,661	186	<b>3,629</b>
High Case	3,289	2,458	361	<b>6,108</b>

Source: ICF International, Inc.

A subset of this information was a 2009 Energy Commission report that focused on wastewater treatment facilities.<sup>4</sup> This study concluded that there could be as much as 450 MW of market potential for CHP at wastewater treatment facilities in California “by adding biodegradable waste from California dairies, food processing plants, and restaurants’ oil and grease to the sludge in the anaerobic digesters.”

### Incentives for CHP

Wastewater treatment facilities located in the Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), or San Diego Gas & Electric Company (SDG&E) service territories qualify for a standard contract for eligible CHP facilities up to 3 MW. The program was created by Assembly Bill 1969 (Yee, Chapter 731, Statutes of 2006) to encourage development of renewable energy at wastewater treatment facilities.

<sup>3</sup> <http://www.energy.ca.gov/2012publications/CEC-200-2012-002/CEC-200-2012-002-REV.pdf>.

<sup>4</sup> <http://www.energy.ca.gov/2009publications/CEC-200-2009-014/CEC-200-2009-014-SD.PDF>.

A different option for CHP facilities up to 20 MW in size is the Waste Heat Recovery and Carbon Emissions Reduction Act, also known as Assembly Bill 1613 (Blakeslee, Chapter 713, Statutes of 2007).<sup>5</sup> This legislation created a feed-in tariff for certified CHP facilities that meet efficiency and performance requirements. The certification of AB 1613 facilities is implemented by the Energy Commission, while the rates are set by the California Public Utilities Commission (CPUC).<sup>6</sup> Certified AB 1613 facilities must submit performance information to the Energy Commission annually to maintain eligibility for the feed-in tariff.<sup>7</sup> As of June 2013, four facilities are certified as eligible under AB 1613; however, none of these facilities has yet signed a power purchase agreement with its local utility. See **Table 2** for the details about currently certified facilities.

**Table 2: AB 1613 Certified Facilities**

Facility	MW	Development Stage	Contract Start Date
Sonoma County	1.4	Operational	N/A
Chevron McKittrick	10.275	Planning	N/A
Pixley Cogen	11.95*	In Progress	N/A
Houweling Tomatoes	13**	In Progress	N/A

\*Currently only 6.3 MW installed.

\*\*Currently only 8 MW installed, expected completion in Fall 2013.

Source: Energy Commission

The Qualifying Facilities Settlement Agreement established a new vehicle for contracting with CHP facilities over 5 MW in the investor-owned utility service territories. The Qualifying Facilities Settlement Agreement set capacity targets for each utility to contract with eligible CHP facilities through competitive solicitations. The CPUC provides semiannual reports on meeting the targets of the settlement agreement each April and October. The CPUC published the most recent report in April 2013, which is available at [www.cpuc.ca.gov/PUC/energy/CHP/settlement.htm](http://www.cpuc.ca.gov/PUC/energy/CHP/settlement.htm).

More recent developments not included in the April 2013 report include the CPUC's approval of the Los Medanos and Calpine Gilroy facilities for half of the capacity proposed by the utilities as a result of their first Qualifying Facilities Settlement Agreement competitive solicitation. The CPUC approved PG&E's capacity procurement of 280.5 MW from Los Medanos. The CPUC approved SCE's capacity procurement of 280.5 MW from Los Medanos and 120 MW from

<sup>5</sup> <http://www.energy.ca.gov/wasteheat/>.

<sup>6</sup> <http://www.cpuc.ca.gov/PUC/energy/CHP/feed-in+tariff.htm>.

<sup>7</sup> Annual performance data are submitted in April.

Calpine Gilroy. The CPUC rejected SCE's proposal to procure 80 MW of capacity from Harbor Cogen. Under the settlement agreement, approved procurement capacity counts toward each utility's megawatt target. The settlement targets and procurement to date are shown in **Table 3**.

**Table 3: Tracking QF Settlement MW Targets**

Utility	CHP Capacity Procured by IOU's to Date (MW)	IOU 2015 CHP Targets (MW)
PG&E	864	1,387
SCE	767	1,402
SDG&E*	56	211
Total	1,687	3,000

\*SDG&E has until 2018 to reach its target.

Source: CPUC

Additional incentives are provided to small, clean, and efficient CHP units through the Self-Generation Incentive Program (SGIP).<sup>8</sup> The SGIP provides rebates for eligible distributed energy systems installed on the customer's side of the utility meter. Eligible technologies include wind turbines, waste heat to power technologies, pressure reduction turbines<sup>9</sup>, internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems.

### Research and Development

The Energy Commission also conducts research through its Research and Development Division that seeks to develop and help bring to market CHP technologies that provide increased environmental benefits, greater system reliability, and lower system cost for communities and utilities across the state.<sup>10</sup>

<sup>8</sup> <http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/>.

<sup>9</sup> Pressure Reduction turbines can control the pressure in pressurized systems using a rotatable barrier device, which generates electricity from the resulting pressure drop. Source: [http://www.cpuc.ca.gov/PUC/energy/Solar/nem\\_cost\\_effectiveness\\_evaluation.htm](http://www.cpuc.ca.gov/PUC/energy/Solar/nem_cost_effectiveness_evaluation.htm)

<sup>10</sup> <http://www.energy.ca.gov/research/renewable/chp.html>.

### **Additional References:**

For information about the CPUC QF Settlement Agreement, Terms Sheet, semiannual reports, and GHG reductions please visit <http://www.cpuc.ca.gov/PUC/energy/CHP/settlement.htm>

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### **Next Update:**

August 2014 with updates provided on an annual basis.